vehicle, in which a vehicle component such as, for example, gripper arms, are moved by means of control levers, it is possible to communicate whether the respectively moved component is being moved into an inadmissible state (for example pressure overloading on grippers), by transmitting information which can be sensed haptically. In particular when controlling gripping arms, excavators, shovels and the like it is necessary to carry out continuous visual monitoring of the direction and speed of the movement so that it is of particular advantage here if the driver does not need to simultaneously also monitor visual displays within the vehicle.

[0014] The transmission of all the necessary data records such as actuator pulses, sensor data, respectively active actuator regions and sensor regions and the like is preferably carried out by means of a suitable network. Examples of a haptic transmission of information are

[0015] a) Load change detection: Acceleration monitors signal a risk of skidding which is parameterized in accordance with the load change gradient, when there are critical load change reactions of the vehicle, via the system. These gradients are communicated to the driver by means of vibrations in the corresponding half of the steering wheel which pulsate to a greater or lesser extent.

[0016] b) Ice monitor: Ice monitors signal the risk of black ice via the haptic sensor when there is frost and a high speed. The haptic signal increases in strength as the speed increases.

[0017] c) Distance warner: When the vehicle undershoots a safety distance from the vehicle traveling in front, a distance warning system outputs signals which pulsate differently depending on the distance measured.

[0018] d) Systems for detecting the edge of the roadway: When the correct marking on the roadway or the centre line is crossed, a system for detecting the edge of the roadway outputs warning signals into the left-hand or right-hand half of the steering wheel via the haptic control element. The warning signals become more intensive the closer the vehicle comes to the edge of the roadway.

[0019] e) Biometric driver monitoring systems: Driver monitoring systems detect the closing of the eyelids and the movement of the eyes and output unpleasant stimulation pulses to the driver via the haptic information element if he falls asleep for a few seconds. The intensity of the pulses increases as the attentiveness of the driver decreases.

[0020] Possible exemplary embodiments of the sensor and actuator systems which are suitable for the haptic information element are, in particular, pressure needle systems, extension needle systems and eccentric systems. In the case of a pressure needle system, the actuator is a matrix or a matrix-like arrangement of moveable needles which are mounted in electromagnetic coils, are sprung on the underside and are actuated in rows and columns. If a voltage is applied to an electromagnetic coil of this arrangement, the needle moves out of the coil and presses against the sensory elements in the driver's hand. The movement can take place from the home state into a static final state which is an alternative thereto; or a continuous vibration of the needles or some of the needles can be generated. The driver then senses a pressure or a slight tickling effect which is interpreted as an information signal. In response, the driver can exert a counterpressure on the needles which have been pushed forward and as a result can bring about an induction current in the coils, or, in the case of a vibration movement, can impede the vibration in such a way that the flow of an induction current is also changed here. The voltage which is induced in this way is detected and evaluated as a sensor signal in order to generate, for example, a visual display or even to change an operating function of the vehicle.

[0021] In an extension needle system, the needles are laterally tilted so that the skin of the hand resting on them is slightly extended. The driver thus senses a change in the surface structure of the object, for example the steering wheel. This change is transmitted as a signal. The technical embodiment corresponds otherwise essentially to the pressure needle system. If a pressure is exerted on the needles in the extension needle system, voltages are thus also induced here in the elements which bring about the orientation of the needles, and said voltages can trigger corresponding reactions of the system.

[0022] In an eccentric system, a motor-operated, rotating eccentric is present as the actuator. The eccentric, actually a wheel with an axis of rotation which is arranged outside the center point, may be a ring or a disk with a certain unbalance or asymmetry. Such an eccentric can be integrated, for example, in the steering wheel. By means of the speed of rotation of the drive, the stimulation impression which is conveyed (vibration frequency) of the eccentric can be changed.

[0023] The active component of a steering wheel which is provided with an eccentric is preferably composed of an elastic material, a plastic or rubber or the like, by means of which the vibrations which are caused by the irregular circulation of the eccentric can be sufficiently transmitted to the outside onto the skin or musculature of the hand of the driver and which can easily be deformed or compressed. In this embodiment also there is preferably provision that when an external pressure is exerted on the vibrating active region of the eccentric and there is an impediment of the eccentric movement which is caused by this, the corresponding sensor signal is transmitted to the system and as a consequence of this a function which relates to the vehicle can be triggered.

[0024] A more precise description of exemplary embodiments will be given with reference to FIGS. **1** to **3**, of which

[0025] **FIG. 1** shows a diagram of a steering wheel with an eccentric device,

[0026] **FIG. 2** shows a diagram of an arrangement of movable needles, and

[0027] **FIG. 3** shows a basic diagram of the means of actuating the haptic information element.

[0028] In **FIG. 1**, the steering wheel of a vehicle is represented diagrammatically. The steering wheel rim **1** is connected to the steering wheel hub **2** by means of webs, spokes or the like, as is customary. Vibration elements **3**—shown here by dashed lines as a concealed contour—are present in the steering wheel rim **1** and are supplied with voltage via electrical feed lines **4**. These vibration elements